

Technical Memorandum LNAPL Characterization and Recovery Pilot Testing Plan

**1190505040 -- Madison County -- ILR000128249
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois**

Prepared for:
THE HARTFORD WORKING GROUP
Hartford, Illinois

Clayton Project No. 15-03095.14.006
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1.0 INTRODUCTION/OBJECTIVES

This Technical Memorandum describes continuing activities to determine the recoverability of Light Non-Aqueous Phase Liquid (LNAPL) within Hartford, Illinois. Activities being conducted include LNAPL characterization, continuing High Vacuum Recovery (HVR) pilot testing and LNAPL recovery modeling.

The objectives of the LNAPL characterization, pilot testing and modeling activities are as follows:

- Determine the composition of LNAPL beneath the Village of Hartford via sampling and analysis, in comparison to existing ROST data.
- Evaluate LNAPL recoverability and rebound, delineate the extent of recoverable free product, and define areas for further HVR pilot testing via baildown testing and soil core sampling.
- Identify the limits and controls on LNAPL recovery via HVR based on an evaluation of removal rates, recovery rates and sustainability throughout the plume.
- Operate the HVR recovery in multiple modes (i.e., low and high vacuum, multiple stinger depths) to compare vacuum enhanced recovery (“slurping”) with dual-phase (i.e. water drawdown) recovery.
- Perform simple spreadsheet modeling using site-specific characterization data to compare HVR with dual-phase and other LNAPL remedial technologies.
- Prepare a technical memorandum summarizing LNAPL characterization results and identifying technologies and locations for potential longer term LNAPL recovery.

2.0 CHARACTERIZATION TASKS

- **LNAPL Sampling.** LNAPL sampling will be conducted within the differing ROST signature areas and differing geological settings. Underlying groundwater

will also be sampled to evaluate interfacial tension. The samples will be collected from wells using a pre-cleaned, sealed, and dedicated polyvinyl chloride (PVC) bailer or obtained directly from the recovery tanks used in the HVR pilot testing. After collection, samples will be immediately placed into new laboratory-supplied containers, labeled, placed in laboratory-provided shipping containers, and delivered under chain-of-custody procedures to an analytical lab. LNAPL samples will be analyzed for typical species fingerprinting (including gasoline and diesel range evaluation), density, viscosity, and interfacial tension. The information from these samples will help determine appropriate locations for core samples and provide input for models used to predict remedial effectiveness. Planned LNAPL sampling locations and testing rationale are shown in the attached Table 2-1. Figures 2-1 through 2-3 show the sampling locations. Sampling is currently planned for the week of August 1, 2005.

- **Product Recovery Tests.** Product recovery and rebound (recharge) tests will be performed as part of ongoing HVR pilot testing conducted by H₂A Environmental, Inc. (H₂A). Recharge data collection methods are outlined in Section 3.0 of this report. Planned test locations and testing rationale are included in the attached Table 2-2. Figures 2-4 and 2-5 show the sampling locations. A proposed H₂A schedule is outlined in Section 3.4 of this report.
- **Baildown Testing.** Baildown testing will be conducted to further refine recoverability under fluctuating potentiometric elevations within differing geological settings, delineate the extent of recoverable free product, and define areas for further pilot testing with H₂A. The tests consist of measuring the initial thickness of the separate phase hydrocarbon in the monitoring well with an oil/water interface probe and then attempting to rapidly remove the separate phase hydrocarbon using a disposable plastic bailer. Upon removal of as much separate phase hydrocarbon as practicable, the rate of recovery in the probe/well will be measured over time. Planned baildown testing includes conducting baildown tests at previously tested locations and conducting testing at new locations. Planned baildown test locations and testing rationale are included in the attached Table 2-3. Figure 2-4 shows the sampling locations. Baildown testing is currently planned for the week of August 15, 2005. Additional baildown testing may be performed on these wells during times of varying water table conditions. The Agencies will be notified of any additional baildown tests.
- **Soil Core Sampling.** Based on the results of the LNAPL sampling, baildown testing, and data evaluation, soil core samples will be collected and analyzed for evaluation of LNAPL recoverability within differing geological and hydrogeological settings. Core samples will be collected via Shelby tube or other “undisturbed” sampling method and selected portions, based on the evaluation of core photography will be analyzed for pore saturation (Dean-Stark Method), grain

size, capillary pressure, fluid density and viscosity. Additional physical soil and fluid tests may be conducted on a select number of samples. Core sampling locations, proposed core sampling methods and other details will be determined based on the above-referenced characterization activities and needs for modeling described in Section 4.0. Core sampling is currently planned for the week of September 19, 2005.

- **Results and Data Evaluation.** The results of the characterization tasks will be used to perform modeling (Reference Section 4.0) and assess the need for additional HVR pilot testing. Characterization activities may be modified to provide appropriate information for modeling. Characterization data will be included in a technical memorandum (Reference Section 5.0).

3.0 PILOT TESTING TASKS

H₂A Environmental, Ltd. (H₂A) has been conducting multi-phase extraction (MPE) pilot testing in Hartford, Illinois since May 9, 2005. H₂A uses a High Vacuum Recovery (HVR) system to extract LNAPL from a well. H₂A's testing uses vacuum-enhanced fluid recovery by applying negative pressure to a well via a stinger pipe set at or near the LNAPL surface. The on-going pilot testing consists of five cycles of Daily HVR Pilot Testing from 10 wells to evaluate LNAPL production and recharge characteristics across the site. The purpose of the pilot testing is to obtain sufficient LNAPL production and recharge data from the site to identify locations where LNAPL is potentially recoverable and the controls and limitations on HVR recovery. .

The pilot testing has been performed utilizing HVR equipment with the flexibility to operate in different applications. During the initial five cycles of screening pilot testing, various vacuum levels, stinger levels, and other operating parameters were tested to obtain preliminary data on LNAPL production and recharge levels that result from different operating parameters. In general, this HVR Pilot Testing has been implemented to maximize LNAPL production while minimizing water production by minimizing drawdown. This pilot testing will continue on a targeted basis. In addition, drawdown

pilot testing from select wells in dual phase extraction (DPE) mode will be implemented utilizing the same equipment in order to compare DPE LNAPL extraction and recharge results to HVR data.

3.1 PILOT TESTING OBJECTIVES

Pilot testing with H₂A will continue with the following objectives:

- Identify LNAPL removal rates via HVR throughout the Hartford LNAPL plume.
- Demonstrate practicality / preference for and limitations on LNAPL focused recovery via HVR.
- Confirm relations between apparent LNAPL thickness and recoverable LNAPL for different hydrogeologic conditions via hourly removal and rebound rates and LNAPL/water ratios.
- Identify periods of optimal recovery of LNAPL via HVR on the basis of source locations, water table elevation, and site stratigraphy.
- Delineate areas where sustained LNAPL recovery is most likely and areas for additional pilot testing, if warranted) based on HVR pilot testing, baildown testing, and LNAPL saturation data.
- In areas identified for sustained LNAPL recovery, define sustainable LNAPL production rates, sustainable LNAPL/water production ratios, optimum operating configurations for HVR (balance vacuum application, LNAPL production, vapor production, water production), and design parameters.

3.2 PILOT TESTING WELLS

Wells identified for pilot testing in the Remedy Selection Technical Memorandum dated March 9, 2005 are the current focus of HVR Daily Pilot Testing (scheduled to conclude July 22, 2005). These wells were chosen based on previous baildown testing results that

indicated relatively fast recharge of LNAPL and observed LNAPL thickness. These wells include:

MP-29D (2-inch PVC)	MP-56C (2-inch PVC)
MP-47C (2-inch PVC)	HMW-19 (2-inch PVC)
MP-50C (2-inch PVC)	HMW-20 (2-inch PVC)
MP-53C (2-inch PVC)	HMW-44C (2-inch PVC)
MP-55C (2-inch PVC)	HMW-48C (2-inch PVC)

Wells that were previously tested are:

RW-4A (4-inch PVC)	RW-5 (4-inch PVC)
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Following conclusion of the current HVR Daily Pilot Testing from the wells above, Extended Pilot Testing will be performed on selected wells to support the LNAPL production and recharge characterization tasks that are part of LNAPL removal Final Remedy determination.

Wells identified for Extended Pilot Testing include:

MP-47C (2-inch PVC)	HMW-19 (2-inch PVC)
MP-50C (2-inch PVC)	HMW-20 (2-inch PVC)
MP-55C (2-inch PVC)	HMW-44C (2-inch PVC)
RW-4A (4-inch PVC)	RW-5 (4-inch PVC)

Wells TBD by LNAPL Investigation

These wells were selected for Extended Pilot Testing in order to understand LNAPL recovery and recharge from the wells investigated to date, to support and extend the plume-wide LNAPL investigation, and to facilitate LNAPL removal technology comparisons.

3.3 PILOT TESTING SCHEDULE

The ten 2-inch-diameter wells cited above are being tested to determine HVR extraction operating parameters, including water/LNAPL/vapor extraction rates. This test was initiated on May 9, 2005 and is projected to be completed by July 22, 2005.

Each of these wells is being operated for one day (approximately 8 hours) at a time to achieve the various objectives identified above. The wells are cycled through for a total of five cycles through each well with approximately two weeks between extraction events for a given well. Production/operation data is analyzed on a daily/weekly schedule (defined in objectives above).

Upon completion of the initial five cycles through these 10 wells (as described above), additional Extended Pilot Testing will be performed from selected wells. The Extended Pilot Testing will consist of the application of H₂A's HVR system in various operating modes to include the following:

- Daily HVR Pilot Testing – operation from one well for an approximate 8 hour weekday to determine LNAPL production and recharge parameters, while minimizing neighborhood disturbances (same as initial five cycles of operation described above).
- Sequential Daily HVR Pilot Testing – Daily HVR Pilot Testing performed on one well for multiple days in succession.
- Continuous HVR Pilot Testing – 24-hour per day HVR Pilot Testing performed on one or more wells for one or more days in succession.

- Daily Dual Phase Extraction (DPE) Pilot Testing – operation of H₂A's HVR system in DPE mode to test drawdown pumping and associated LNAPL production and recharge utilizing either a downhole pump in conjunction with the vacuum generation system capabilities or utilizing a downhole stinger to effect fluid drawdown.
- Continuous DPE Pilot Testing – 24-hour per day DPE Pilot Testing performed on one or more wells for one or more days in succession.

The proposed wells and schedule for the Extended Pilot Testing are outlined below:

HMW-44C	Sequential Daily HVR Pilot Testing (approximately 4 weeks) Start Date: July 25, 2005 End Date: August 19, 2005
HMW-19	Sequential Daily HVR Pilot Testing (approximately 2 weeks) Start Date: August 22, 2005 End Date: September 2, 2005
MP-50C	Sequential Daily HVR Pilot Testing (approximately 1 week) Start Date: September 6, 2005 End Date: September 9, 2005
MP-47C	Sequential Daily HVR Pilot Testing (approximately 1 week) Start Date: September 12, 2005 End Date: September 15, 2005
MP-55C	Sequential Daily HVR Pilot Testing (approximately 1 week) Start Date: September 19, 2005 End Date: September 23, 2005
HMW-20	Sequential Daily HVR Pilot Testing (approximately 1 week) Start Date: September 26, 2005 End Date: September 30, 2005
RW-4A	Sequential Daily HVR Pilot Testing (approximately 2 days) Start Date: October 3, 2005 End Date: October 4, 2005
RW-5	Sequential Daily HVR Pilot Testing (approximately 2 days) Start Date: October 5, 2005 End Date: October 6, 2005

RW-4A	Daily DPE Pilot Step Testing (approximately 1 day) Start Date: October 10, 2005 End Date: October 10, 2005
RW-4A	Continuous DPE Pilot Testing (approximately 4 days) Start Date: October 11, 2005 End Date: October 14, 2005
RW-5	Daily DPE Pilot Step Testing (approximately 1 day) Start Date: October 17, 2005 End Date: October 17, 2005
RW-5	Continuous DPE Pilot Testing (approximately 4 days) Start Date: October 18, 2005 End Date: October 21, 2005
RW-4A	Continuous HVR Pilot Testing (approximately 2 weeks) Start Date: October 24, 2005 End Date: November 4, 2005
RW-5	Continuous HVR Pilot Testing (approximately 2 weeks) Start Date: November 7, 2005 End Date: November 18, 2005
Wells TBD	Daily and/or Sequential Daily HVR Pilot Testing (approximately 5 weeks) Start Date: November 22, 2005 End Date: December 31, 2005

3.4 EQUIPMENT

3.4.1 Daily, Sequential Daily and Continuous HVR, Daily and Continuous DPE Pilot Tests

Equipment necessary to undertake these Pilot Tests includes the following:

- Internal Combustion Engine (ICE) based mobile trailer-mounted HVR system with total fluids Knock Out tank and transfer pump and vapor abatement via ICE. Maximum vacuum generation of 21-inches mercury (Hg) (max 15 inches Hg)

applied to well), max flow rate of 60 standard cubic feet per minute (SCFM) combined flow.

- External temporary storage tank(s) for produced groundwater and LNAPL.
- Vacuum truck for transport and recycling of produced fluids.
- Hand-held digital manometer to measure well vacuum.
- Thermal anemometer to measure airflow in air dilution valves (ADV).
- Electronic Interface Probe (EIP) to measure LNAPL thickness and depths to LNAPL and water in wells.
- Data logger and pressure transducers.
- Vacuum transmitters and data logger.
- Various piping and hose configurations to seal and apply vacuum to wells and to transmit produced vapors and fluids to the trailer and transfer produced fluids into the external storage tank(s).
- Forklift or other appropriate vehicle to move the storage tank(s).
- Support trucks.
- Traffic control equipment.
- Summa canisters for air sampling of influent concentrations.
- Photoionization Detector (PID) to monitor influent versus effluent engine vapor concentrations.
- Various system-specific systems to measure system operating parameters (vacuums, flow rates, revolutions per minute [RPMs], British Thermal Unit [BTUs], etc.).
- Miscellaneous support equipment and tools.

3.5 PILOT TESTING PROTOCOL

3.5.1 Daily HVR Pilot Test Protocol

The operational protocol for the initial five cycles of Daily HVR Pilot Tests that began on May 9, 2005 will also be followed for Daily HVR Pilot Tests to be conducted on other wells to be determined by the LNAPL investigation. This protocol is as follows: upon arriving at a removal site, the HVR system is set as near the extraction well as possible, but at a location so as not to create disruption to traffic flow or an inconvenience to local residences. The area is marked off with traffic cones and/or safety barriers. The extraction well is then opened and gauged for depth to product (DTP) and depth to water (DTW) using an Electronic Interface Probe (EIP).

The extraction well is capped with a sanitary seal allowing installation of the extraction stinger and ambient air valve. Once all the hoses are in place, the system is started, and recovery commences. The system is optimized for product recovery in the extraction well. Produced media are separated in an onboard knockout tank. Vapors are treated (burned) in the Internal Combustion Engine (ICE) while the liquid product and produced water are temporarily stored in an external storage tank for subsequent transportation to Ecological Systems, Inc. (ESI), Indianapolis, Indiana for blending and beneficial re-use.

During the daily pilot testing, system operating parameters are automatically tracked by an onboard logging system. Vapor recovery is quantified by the logging system based on produced BTUs per hour and other relevant operating parameters. Water and liquid product recovery quantities are quantified manually by gauging the external storage tank with a measuring rod and water-finding paste.

Air samples are collected in SUMMA canisters, packaged, and shipped to Columbia Analytical Services (CAS) in Simi Valley, California. The air samples are analyzed for

total petroleum hydrocarbons (TPH) and methane using a modified EPA Method TO-3. Samples are also analyzed for a select list of compounds under EPA Method TO-15. During the sample collection, the influent vapor concentration is monitored with a PID.

Following the completion of the extraction event, the external storage tank is gauged for water and LNAPL quantities. The well is gauged for DTP and DTW for approximately 6 to 8 hours to obtain recharge data on the well. Arrangements are made for the pickup of the fluids from the external tank. The barricades and/or traffic cones are picked up, and the system is demobilized.

3.5.2 Sequential Daily HVR Pilot Test Protocol

Following completion of the initial five cycles of Daily HVR Pilot Testing described previously, Sequential Daily HVR Pilot Tests will be conducted from HMW-44C, HMW-19, MP-47C, MP-50C and MP-55C to identify the sustainability of LNAPL production and recharge in these wells, which exhibited moderate to significant LNAPL production and recharge during the initial 5 cycles of Daily HVR Pilot Testing. Sequential Daily HVR Pilot Testing will be performed from HMW-20 to document the limits of LNAPL production and recharge apparently attained during the initial five cycles of Daily HVR Pilot Testing. Sequential Daily HVR Pilot Testing will be performed from wells RW-4A and RW-5 to establish baseline and optimal LNAPL production characteristics for these wells prior to conducting the Daily and Continuous DPE and Continuous HVR Pilot Tests from these two wells.

The Sequential Daily HVR Pilot Tests will be conducted in general accordance with the previously described Daily HVR Pilot Test protocol, though traffic control for the tests at wells RW-4A and RW-5 will be minimal or not required since these wells occur in controlled access space. Currently RW-4A and RW-5 have operating skimmer pumps installed. At least one week prior to conducting the Sequential Daily HVR Pilot Tests

from these wells the skimmer pumps will be removed to allow recharge of LNAPL and groundwater into these wells to static conditions. The fluid recharge in these wells will be measured for approximately 6-8 hours following removal of the skimmer pumps and once each subsequent day prior to initiation of the Sequential Daily HVR Pilot Tests in order to ensure documentation of baseline recharge conditions.

3.5.3 Daily DPE and Continuous DPE Pilot Test Protocol

In addition to the various HVR Pilot Tests that will be conducted on RW-4A and RW-5 over an extended period, DPE Pilot Tests will be performed to compare HVR, DPE and skimming from these wells with respect to LNAPL production and recharge rates and radii of influence. The DPE tests to be performed include Daily DPE Pilot Step Tests and Continuous DPE Pilot Tests.

Following completion of the Sequential Daily HVR Pilot Tests from RW-4A and RW-5, the Daily DPE Pilot Tests will be performed for up to eight hours to identify fluid production capabilities of the well to ensure adequate fluid handling infrastructure and protocols are in place. If the results of the Daily DPE Pilot Step Tests are favorable, then the Continuous DPE Pilot Tests will be initiated following conclusion of the Daily tests. The Daily and Continuous DPE Pilot Tests are scheduled in between the Daily HVR Pilot Tests and Continuous HVR Pilot Tests in order to evaluate any diminishing LNAPL recharge and production effects that may occur and factor them into the technology comparisons.

After completion of the Sequential Daily HVR Pilot Tests but prior to conducting each Daily DPE Pilot Step Test, all surrounding wells within a 200-foot radius of the extraction well will be monitored for vacuum levels and gauged for product thickness and groundwater levels. The actual number of wells to be gauged during the tests will be determined based on field observations of drawdown and vacuum influence. Once pre-

test levels have been established, the extraction well and select surrounding monitoring wells will be equipped with pressure transducers to measure piezometric levels (drawdown), which will be recorded via an automatic data logger. In addition, select wells will be equipped with pressure transmitters to measure the vacuum in the well during the pilot test. Periodically, the well caps will be removed to manually gauge the wells for product thickness. Barometric pressure data will be obtained from the site's local weather monitoring station.

To conduct the Daily DPE Pilot Step Tests and Continuous DPE Pilot Tests, the extraction well will be equipped with a wellhead through which the vacuum hose (stinger) and pump lines (if utilized), pressure transducer, and transmitters will be placed. In general, the Daily DPE Pilot Step Tests will be started with running "step tests" to determine the optimal operating parameters and fluid production rates at various drawdown levels and/or pumping rates. Fluid levels and vacuum readings (as appropriate) will be collected from the extraction well and select surrounding monitoring wells. Additionally, product recovery and water recovery will be monitored to determine the LNAPL/water ratio. Water and liquid product recovery will be quantified manually by gauging the external storage tank. Vapor recovery will be automatically tracked and quantified by an onboard data logging system based on produced BTUs per hour and other relevant operating parameters.

When the optimal operating parameters have been established and anticipated fluid production rates have been confirmed to occur within available fluid management infrastructure and protocol limits, the Continuous DPE Pilot Test will be initiated. Periodically as conditions change, these optimal operating levels may be adjusted to meet the overall objective of maximizing LNAPL and vapor recovery.

During the Continuous DPE Pilot Tests, fluid production rates, vacuum measurements and fluid levels will be obtained on a standard decelerating pumping test schedule for the

extraction well and select surrounding monitoring wells. Periodically the wells will be opened and LNAPL thickness measurements will be obtained.

Influent air samples will be collected daily during the pilot tests to confirm vapor recovery rates. The air samples will be collected in Summa canisters and analyzed using (but not limited to) EPA Methods TO-3 and TO-15.

At the completion of each Continuous DPE Pilot Test, the extraction and selected monitoring wells will be monitored for a minimum of 24 hours to obtain recharge data. The wellheads will be removed, and the wells will be gauged for water levels as well as product thickness to determine recharge to the wells.

3.5.4 Continuous HVR Pilot Test Protocol

Following completion of the Continuous DPE Pilot Tests and recharge data collection, the Continuous HVR Pilot Tests from wells RW-4A and RW-5 will be conducted. The Continuous HVR Pilot Tests will be conducted according to essentially the same protocol as the Continuous DPE Pilot Tests with the exception that operation will be conducted in such a manner as to minimize water and maximize LNAPL production. Operating parameters, fluid production rates and ratios, and select well fluid levels and vacuum data will be obtained on the same standard decelerating pumping test schedule as the Continuous DPE Pilot Tests.

4.0 MODELING TASKS

The Hartford Working Group (HWG) will complete modeling to evaluate LNAPL recoverability at the site. The American Petroleum Institute (API), which includes the Charbeneau models and other source dissolution models, will be used to evaluate the need and/or rationale for comparing the effectiveness of free-product recovery methods.

The model evaluates different free-product removal techniques including single and dual pump well systems, skimmer systems, vacuum-enhanced systems and trenches. The model is relatively simple and is expected to help evaluate the relative merits of different recovery techniques. Initial modeling will be performed using default input parameters followed by a more site-specific model with data from the characterization activities proposed in this report. Modeling activities will be completed by February 6, 2006.

5.0 DATA ANALYSIS AND DELIVERABLES

5.1 DATA ANALYSIS

The infrastructure, operating, production, drawdown, radius of influence, and recharge data from the Pilot Tests will be analyzed to develop the following information:

- Water and LNAPL fluid production quantities and rates.
- Vapor production quantities and rates.
- Analysis of operating parameters versus well infrastructure and stratigraphic boundaries.
- Calculation of formation hydraulic conductivity (K) and Transmissivity (T) for each well (where possible).
- Calculation of LNAPL “K” and “T” values (where possible).
- Detailed recharge curve analyses versus production rates, well infrastructure, stratigraphic boundary, and fluid level conditions.
- Analysis of observed radii of influence (ROI) in comparison to calculated ROI values.
- Analysis of various operating parameters versus production data to evaluate optimal operating parameters to maximize LNAPL production.

5.2 DELIVERABLES

- Daily summary pilot test reports with cover page, graphical, and tabular operating and production summaries.
- Weekly summary and analysis pilot test reports with cover page, graphical data summaries and analyses, and tabular production summaries.
- Summary pilot testing data analyses to support the proposed LNAPL characterization, baildown tests, and saturation curve development efforts (e.g. maps with hourly LNAPL production rates contoured, maps of contoured LNAPL/water production ratios, 1-day removal rates, and recharge, and individual well analyses to evaluate production data versus hydrogeologic and infrastructure factors to identify limiting production characteristics, and others).
- Interim pilot testing and LNAPL production reports.
- Detailed analyses of LNAPL/vapor/water production data versus site fluid levels to determine optimum LNAPL recovery conditions and ROI with respect to local/regional water levels and seasonal variations.
- Detailed pilot testing data analysis and summary report with recommendations.

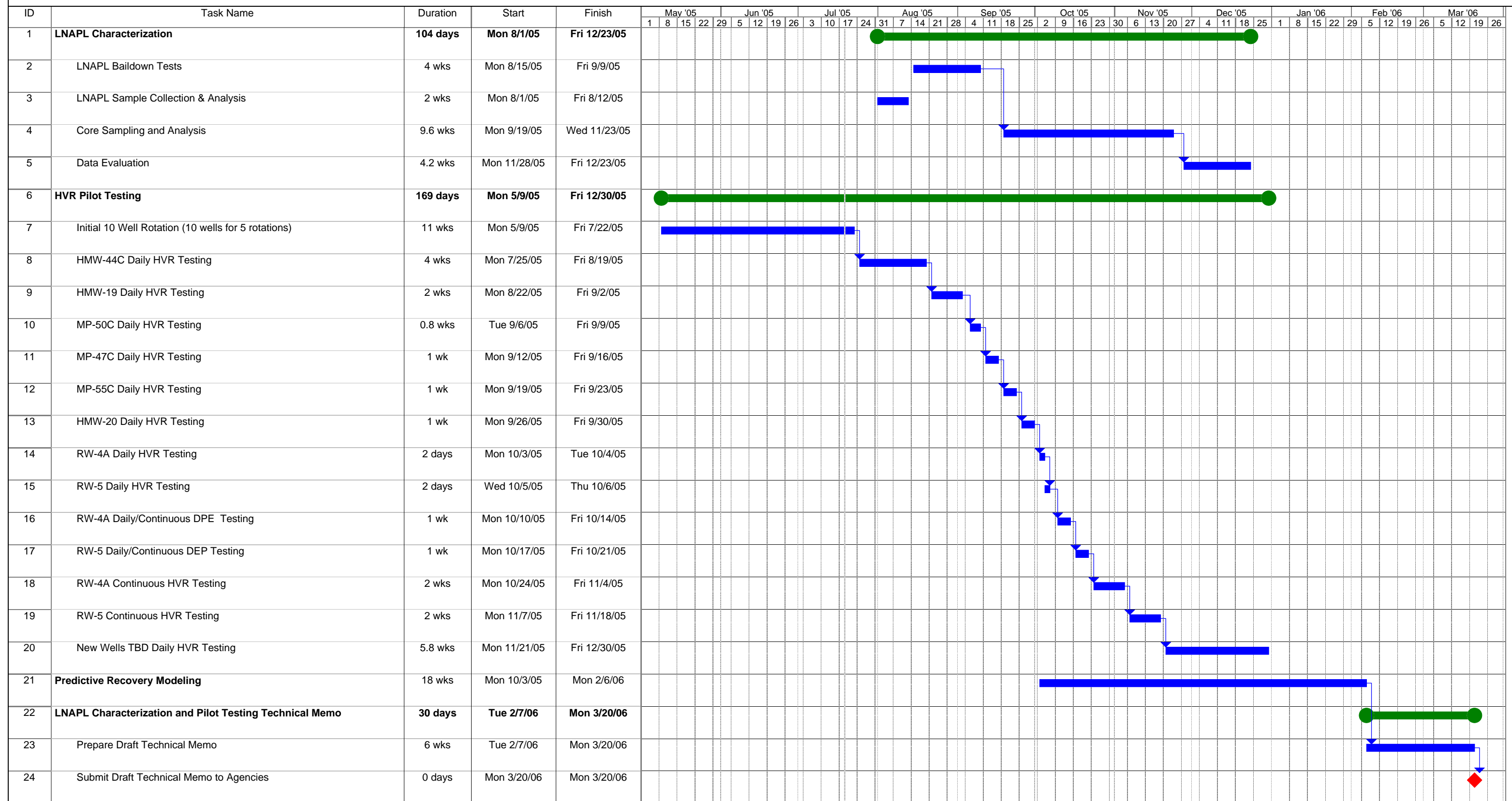
A technical memorandum will be submitted within 90 days of completion of characterization, Pilot Testing and modeling activities. The memorandum will summarize the field procedures used to perform the Pilot Tests and characterization activities, data collected, conclusions drawn from the data, and modeling results.

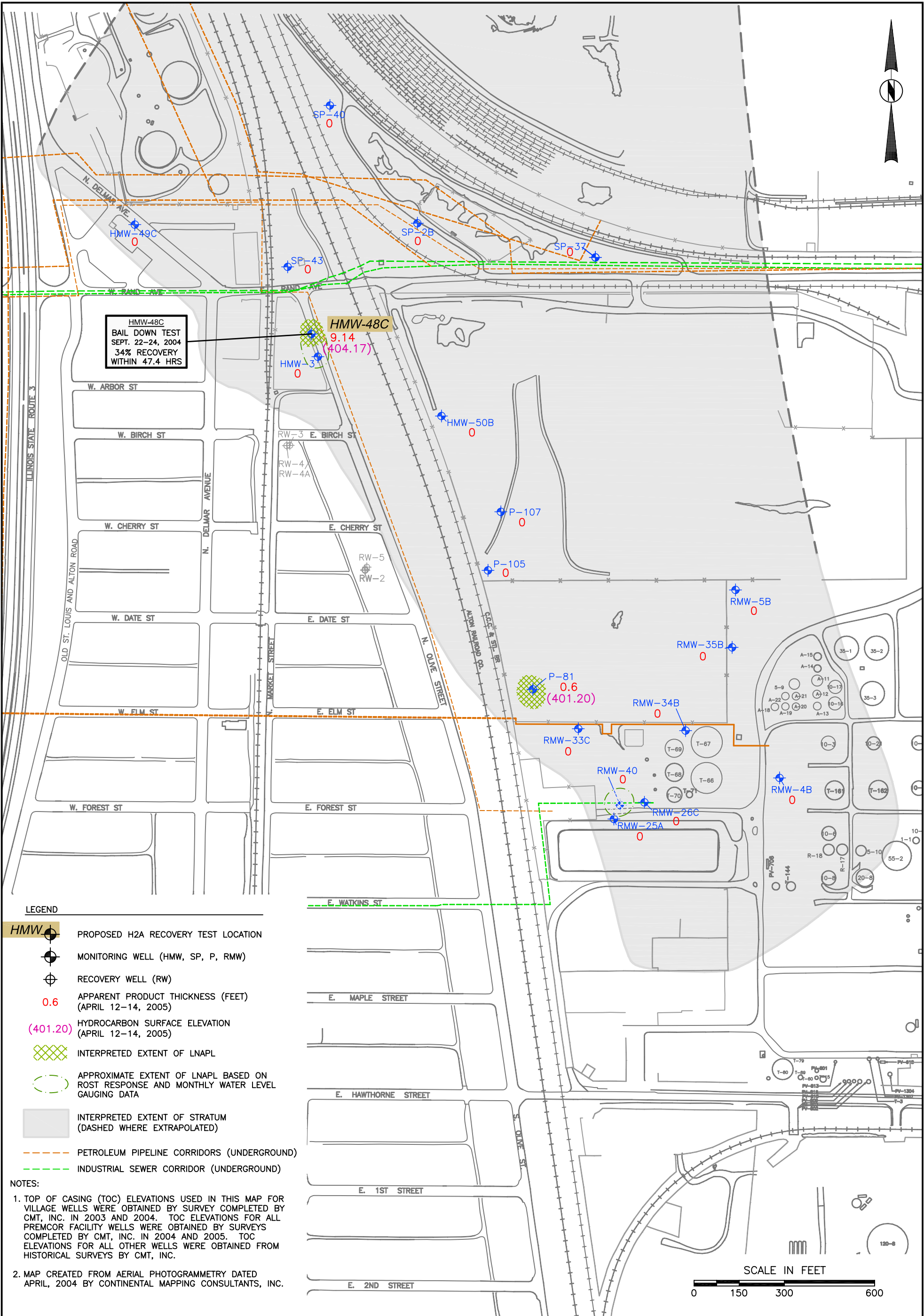
Interpretive discussions of the results and available data will be presented in tabular form as well as graphically, and appropriate findings stated. The technical memorandum will compare remedial technologies for remedy selection and/or to identify areas where longer-term pilot testing of LNAPL recovery, if necessary, is warranted. A schedule chart presenting the planned activities is shown in Figure 5-1.

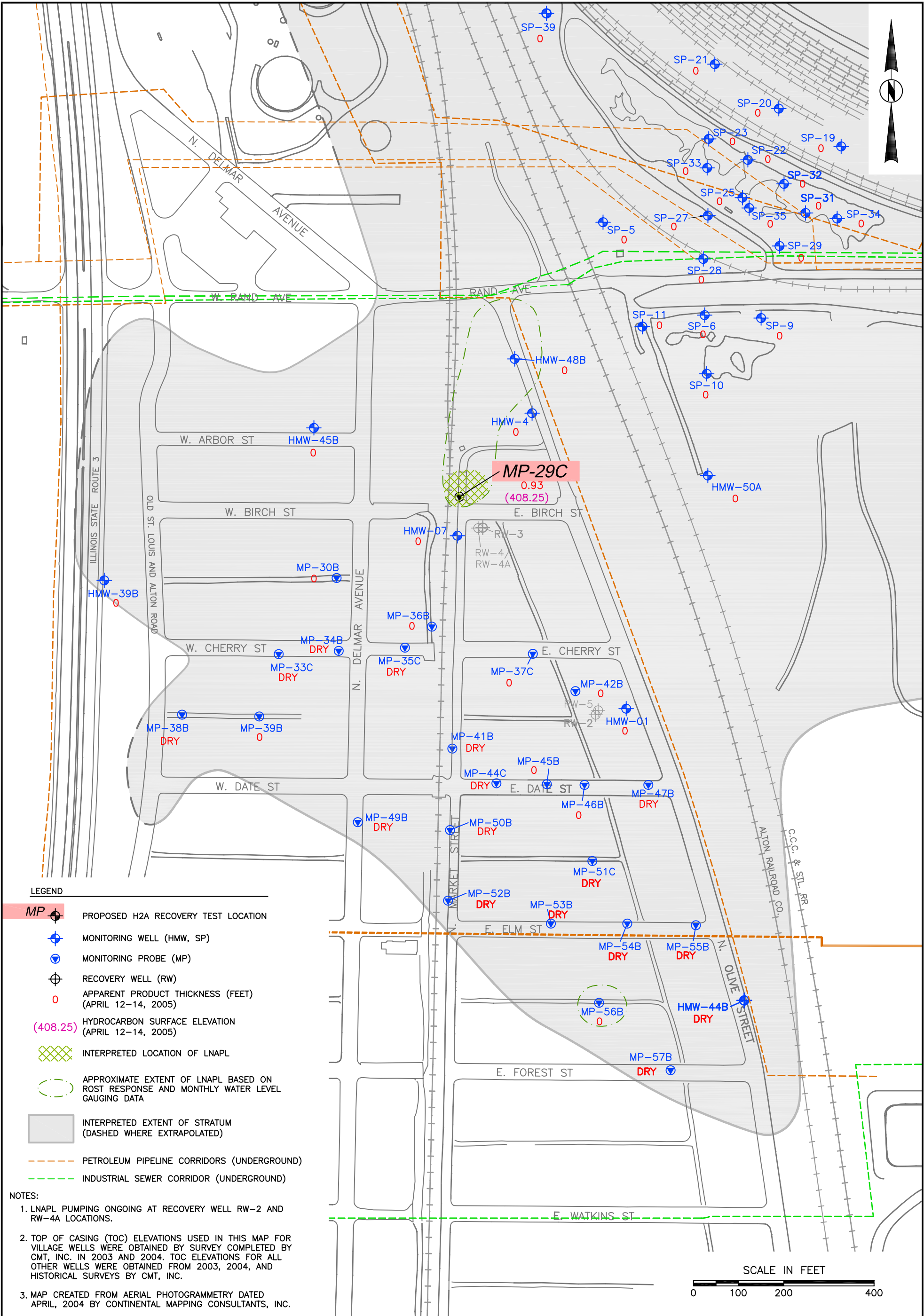
FIGURES

TABLES

Hartford, Illinois







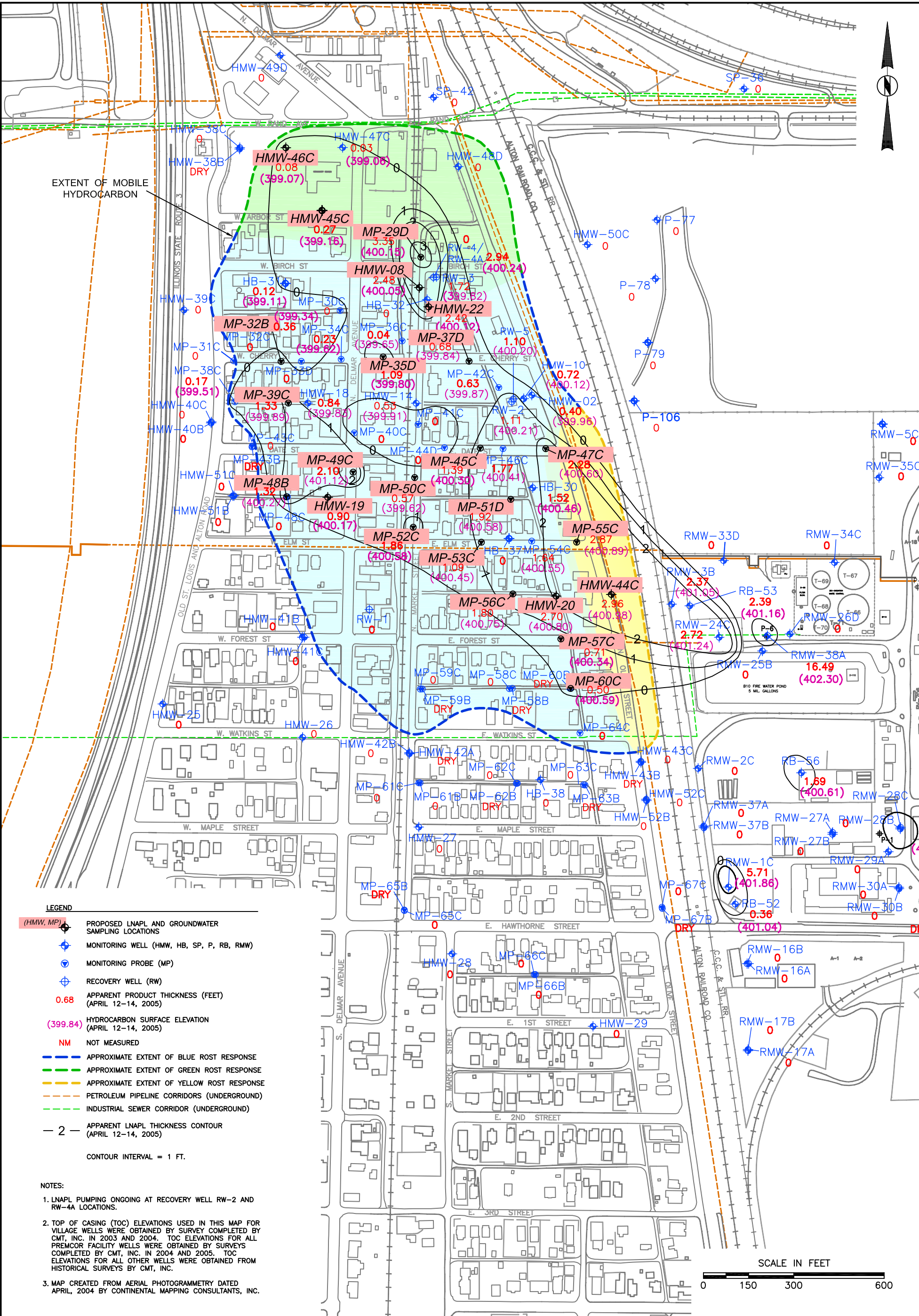


TABLE 2-3
PROPOSED BAILOWN TEST WELLS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
HMW-18	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
HMW-22	MAIN	GREEN/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
HMW-45C	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
MP-35D	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-39C	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-45C	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EAST/CENTRAL PORTION OF PLUME
MP-48B	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-49C	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WEST/CENTRAL PORTION OF PLUME
MP-52C	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME

NOTES:

The baildown test activities at the above locations will be conducted with a bailer or equivalent.

**TABLE 2-2
PROPOSED H2A RECOVERY TEST WELLS**

**1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois**

WELL	STRATUM	TESTING RATIONALE
HMW-19	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
HMW-20	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-44C	MAIN	REPRODUCIBILITY OF INITIAL TEST
		YELLOW ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-48C	EPA	REPRODUCIBILITY OF INITIAL TEST
		GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		APPARENT CENTRAL PORTION OF PLUME
MP-29D	MAIN	REPRODUCIBILITY OF INITIAL TEST
		GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
MP-47C	MAIN	REPRODUCIBILITY OF INITIAL TEST
		YELLOW/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-50C	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-53C	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL/EASTERN PORTION OF PLUME
MP-55C	MAIN	REPRODUCIBILITY OF INITIAL TEST
		YELLOW/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-56C	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		SOUTH/CENTRAL PORTION OF PLUME

NOTES:

The recovery test activities at the above locations will be conducted as part of the H2A pilot test activities.

**TABLE 2-1
PROPOSED LNAPL SAMPLING LOCATIONS**

**1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois**

WELL	STRATUM	TESTING RATIONALE
HMW-08	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
HMW-19	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WEST/CENTRAL PORTION OF PLUME
HMW-20	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-22	MAIN	GREEN/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
HMW-44C	MAIN	YELLOW ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-45C	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
HMW-46C	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
HMW-48C	EPA	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		APPARENT CENTRAL PORTION OF PLUME
MP-29C	RAND	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		APPARENT CENTRAL PORTION OF PLUME
MP-29D	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
MP-32B	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-35D	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
MP-37D	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-39C	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-45C	MAIN	BLUE ROST SIGNATURE AREA
		BLUE ROST SIGNATURE AREA

**TABLE 2-1
PROPOSED LNAPL SAMPLING LOCATIONS**

**1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois**

WELL	STRATUM	TESTING RATIONALE
MP-45C	MAIN	AREA OF APPARENT LNAPL ACCUMULATION EAST/CENTRAL PORTION OF PLUME
MP-47C	MAIN	YELLOW/BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION EASTERN PORTION OF PLUME
MP-48B	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION WESTERN PORTION OF PLUME
MP-49C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION WEST/CENTRAL PORTION OF PLUME
MP-50C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION CENTRAL PORTION OF PLUME
MP-51D	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION EASTERN PORTION OF PLUME
MP-52C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION SOUTH/CENTRAL PORTION OF PLUME
MP-53C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION EAST/CENTRAL PORTION OF PLUME
MP-55C	MAIN	YELLOW/BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION EASTERN PORTION OF PLUME
MP-56C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION EAST/CENTRAL PORTION OF PLUME
MP-57C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION EASTERN PORTION OF PLUME
MP-60C	MAIN	BLUE ROST SIGNATURE AREA AREA OF APPARENT LNAPL ACCUMULATION SOUTHEAST PORTION OF PLUME

NOTES:

Actual sample locations subject to change based on field conditions.

Proposed analysis to consist of: DRO, GRO, typical species fingerprinting, density, viscosity, and interfacial tension.

LNAPL and groundwater samples to be collected at the following wells with the H2A HiVAC Remediation rig: HMW-15

HMW-20, HMW-44C, HMW-48C, MP-29D, MP-47C, MP-50C, MP-53C, MP-55C, and MP-56C.

LNAPL and groundwater samples at the remaining wells to be collected by bailer or equivalent sampling device.

HMW-08, HMW-22, HMW-45C, HMW-46C, MP-29C, MP-32B, MP-35D, MP-37D, MP-39C, MP-45C, MP-48B, MP-49

MP-51D, MP-52C, MP-57C, and MP-60C.

Simulated distillation analysis previously completed on the following wells: HMW-44C, HMW-46C, HMW-48C, MP-29C

MP-29D, MP-32B, MP-35D, MP-37D, MP-39C, MP-45C, MP-47C, MP-49C, MP-52C and MP-55C.